Patent claims

1. An injection device for a syringe, having a syringe body, a cannula with a needle, a plunger with a plunger rod, and an injection carriage for displacing the syringe body and the plunger, and having at least one actuating element that acts on the injection carriage to carry out the injection procedure, characterized in that the actuating element (120, 220, 320) cooperates with components which withdraw the needle (108, 208, 308) from the puncture site once the injection procedure has been completed, using a return stroke (H3) that is applied to the injection carriage.

2. The injection device as claimed in claim 1, characterized in that the injection procedure includes an insertion stroke (H1), and in that the return stroke (H3) substantially corresponds in magnitude to the insertion stroke (H1) and, compared to the latter, acts on the syringe in the opposite direction.

3. The injection device as claimed in claim 1 and claim 2, characterized in that the injection procedure is formed by the insertion stroke (H1) and by a subsequent injection stroke (H2) with which the plunger (104, 204, 304) is displaced in the syringe body (101, 201, 301) and the injection liquid is injected.

4. The injection device as claimed in claims 1 through 3, characterized in that the injection carriage includes a syringe holder (140, 240, 340) in which the syringe body (101, 201, 301) is mounted for the insertion stroke (H1), and a ram (150, 250, 350) which can be displaced against the syringe holder in order to act on the plunger rod

(105, 205, 305) for the injection stroke (H2).

5. The injection device as claimed in claim 4, characterized in that syringe holder (140, 240, 340) and ram (150, 250, 350) are coupled releasably to one another in such a way that they are acted on jointly by the actuating element in the insertion stroke (H1) and in such a way that only the ram (150, 250, 350) is acted upon in the injection stroke (H2).

6. The injection device as claimed in claim 1, characterized in that the actuating element is a push rod (120, 220) which is guided parallel to the injection carriage in a housing (110, 210) and by means of which, when it is pushed into the housing (110, 210), the components for producing the return stroke (H3) are also activated.

7. The injection device as claimed in claim 6, characterized in that the components for producing the return stroke (H3) include at least one toothed wheel (113) which engages in the injection carriage (140, 150) and in the push rod (120) and which is mounted in a carriage (114A) displaceable in the housing (110), and in that the toothed wheel (113) cooperates with a blocking element which blocks the toothed wheel (113), when insertion stroke (H1) and injection stroke (H2) are performed, and which thereafter releases the toothed wheel (113), as a result of which the linear movement of the push rod (120) is converted into the oppositely directed return stroke (H3) of the injection carriage (140, 150).

8. The injection device as claimed in claim 7, characterized in that at least two toothed wheels (113A, 113B) for converting the linear movement of the push rod (120) into the return stroke (H3) are

provided in the common carriage (114A).

9. The injection device as claimed in claim 7, characterized in that the blocking element is a pawl (114) which is linearly displaceable on the carriage (114A) and which, in the blocking position, engages in the teeth of the toothed wheel (113).

10. The injection device as claimed in claim 7, characterized in that the blocking element is a pivot lever (114B) which, in the blocking position, engages in the teeth of the push rod (120).

11. The injection device as claimed in claims 3 through 6, characterized in that the coupling between syringe holder (140) and ram (150) is effected by two slide blocks (145A, 145B) which can be brought into a releasable positive engagement between syringe holder (140) and housing (110), and between syringe holder (140) and ram (150).

12. The injection device as claimed in claims 3 through 7, characterized in that the coupling between syringe holder (140) and ram (150) is effected by a further toothed wheel (113C) which is likewise held in the carriage (114A) and which is blocked during the insertion stroke (H1).

13. The injection device as claimed in claim 6, characterized in that the components for producing the return stroke (H3) include at least one spring element (261A, 261B) as energy accumulator which, before the start of the injection, is pretensioned by the push rod (220) (tensioning stroke) and, after the injection stroke (H2), is released, in order to produce the return stroke (H3) by acting

abruptly on a return carriage (260) which is releasably connected to the injection carriage and which bears on the syringe holder (240).

14. The injection device as claimed in claim 13, characterized in that a rotatably mounted control lever (221) is provided in the push rod (220), one end of this control lever (221) engaging in the injection carriage (240, 250) when the tensioning stroke has been completed.

15. The injection device as claimed in claim 14, characterized in that the control lever (221), by turning about a control angle, also effects the release of the coupling between syringe holder (240) and ram (250) at the transition from the insertion stroke (H1) to the injection stroke (H2).

16. The injection device as claimed in claim 13, characterized in that the return carriage (260) has pincer-like locking elements (262A, 262B) which, after the injection stroke (H2), engage in recesses (226A, 226B) of the push rod (220) and release the return stroke (H3).

17. The injection device as claimed in claim 1, characterized in that the actuating element includes a pull-out loading bar (320) which, when pulled out from the housing (310), pretensions at least one advancer spring (324) as energy accumulator, and a trigger mechanism (370) which, after activation, releases the injection carriage (340, 350) acted upon by the advancer spring (324) via an advancer carriage (323) for automatic execution of insertion stroke (H1), injection stroke (H2) and return stroke (H3).

18. The injection device as claimed in claim 17,

characterized in that the pull-out loading bar (320), after it has been pulled out from the housing (310), pretensions at least one restoring spring (325) as energy accumulator for automatic return of the pull-out loading bar (320).

19. The injection device as claimed in claim 17, characterized in that the advancer spring (324) and the restoring springs (325) are scroll springs.

20. The injection device as claimed in claim 17, characterized in that the trigger mechanism (370) is coupled to at least one safety element (371) which in particular permits triggering only when the injection device is placed on the insertion site.

21. The injection device as claimed in claim 17, characterized in that pull-out loading bar (320), advancer springs (324, 325), injection carriage (340, 350) and advancer carriage (323) are held in a receiving frame (312) in such a way that they can be displaced parallel to one another.

22. The injection device as claimed in one of the preceding claims, characterized in that, in order to control the processes, in particular the sequence of insertion stroke (H1), injection stroke (H2) and return stroke (H3), control elements that can be brought into and out of positive/frictional engagement with one another are provided, in particular on the actuating element (120, 220, 320), on the syringe holder (140, 240, 340), on the ram (150, 250, 350) and on the housing (110, 210) or receiving frame (312).

23. The injection device as claimed in claim 21, characterized in that the control elements include

elastic sections, locking cams, slide-on planes and cutouts.

24. The injection device as claimed in claim 17, characterized in that, in order to pretension the advancer spring (424), the pull-out loading bar is replaced by a pull-out loading wire (420), one end of which has a grip (420B) on an end of the housing (410), and which has a carrier (420A) which is connected to the advancer spring (424) and engages on the advancer carriage (423) when the grip (420B) is pulled out.

25. The injection device as claimed in claims 18 and 24, characterized in that the pretensioning of the restoring spring (425) likewise takes place via the grip (420B) and the pull-out loading wire (420), as a result of which the pull-out loading wire (420) is pulled into the housing (410) until it abuts against the grip (420B) on the housing (410).

26. The injection device as claimed in claims 24 and 25, characterized in that advancer spring (424) and restoring spring (425) are designed as helical springs, one end of which is secured in a frame (412) held in the housing (410), and the other end of which is connected to the pull-out loading wire (420) either directly or via the carrier (420A).

27. The injection device as claimed in claims 24 and 26, characterized in that the other end of the pull-out loading wire (420) is connected to a receiving frame (412) held in the housing and is guided over at least one pull roller (420D) on whose shaft the other end of the restoring spring (425) is held, so that the tensile force applied by the restoring spring (425) on the pull-out loading wire (420) corresponds according to the

number of pull rollers (420D) only to a fraction of the spring force of the restoring spring (425) (first pulley block).

28. The injection device as claimed in claims 24 through 27, characterized in that the advancer spring (424) is connected to the receiving frame (412) via a traction wire (424B) which is guided over at least one pull roller (424D) on whose shaft the other end of the advancer spring (424) is held, so that the tensile force applied by the advancer spring (424) to the traction wire (424B) and thus to the advancer carriage (424D) is only a fraction of the spring force of the advancer spring (424) (second pulley block).

29. The injection device as claimed in claim 1, characterized in that a damping unit (492) is assigned to the actuating element and/or to the injection carriage (440, 450).

30. The injection device as claimed in claim 1, characterized in that additional components are provided which produce a time delay (TV) between the completion of the injection procedure and the start of the return stroke (H3).

31. The injection device as claimed in claim 30, characterized in that the additional components cancel the frictional coupling between ram (450) and advancer carriage (423) as the advancer carriage (423) continues to move for the duration of the time delay (TV).

32. The injection device as claimed in claim 31, characterized in that the duration of the time delay (TV) is adjustable.

33. The injection device as claimed in claims 1 and 4,

characterized in that a volume adapter (410) can be inserted into the ram (450) and predetermines the injection stroke (H2) and thus the quantity of a medicament that is administered during the injection stroke (H2).

34. The injection device as claimed in claims 7, 24 and 30, characterized in that at least two toothed wheels mounted in the carriage (414, 415) and belonging to a pair of toothed wheels (413, 513) for gearing up or gearing down between the linear movement of the carriage (414, 514) and of the advancer carriage (423) are provided, on which at least one spring element engages for producing the strokes (H1, H2, H3) and the time delay (TV).

35. The injection device as claimed in claim 34, characterized in that the advancer carriage (423) is formed by a toothed belt (523).